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No. 12.

**A description of two New Species of Anostracan Phyllopoda from
Western Australia.**

(With one Text Figure 9 a, b, c, and three Plates IV., V. and VI.)

By

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As one result of a visit made by Professor G. E. Nicholls to Dalgaranga Station, Yalgoo, during the Easter vacation, 1926, a number of fresh water Phyllopods were collected. They were to be found in abundance in shallow rock pools and muddy hollows in which water had accumulated after heavy flood rains. As might be expected from an area hitherto unexplored zoologically, the collection is a valuable one and contains many interesting forms of Anostracan, Notostracan and Conchostracan Phyllopoda.

I desire to take this opportunity of expressing my thanks to Professor Nicholls, who has kindly put the collection at my disposal and has given me every assistance in facilitating their study.

Of the Anostraca on which I have commenced my investigation there are several new species, and I have no doubt that a complete examination of the entire collection will result in the discovery of further new forms.

The largest specimens of the collection, measuring little more than an inch in length, prove to be a new species of *Branchinella* (Sayce) and its most remarkable feature is the relatively enormous development of the frontal appendage. In this form, for which I propose the name *Branchinella mirabilis*, the frontal outgrowth, which is developed in the male only as an accessory clasping organ during copulation, attains a much greater size and degree of complexity than it does in any other species of *Branchinella*. In the complicated character of the frontal appendage it more nearly resembles *Chirocephalus* (Prevost) or *Dendrocephalus* (Daday), but differences in a number of important characters prevent its being assigned to either of these genera.

Closely allied to *Branchinella mirabilis* is another form which was taken from a pool some distance from the collecting ground of the first. Whilst only half the size of the former, it resembles it in general appearance, possessing, also, a prominent and complicated frontal appendage which differs, however, in shape from that of *Branchinella mirabilis* and from other described species. I have named this second new species *Branchinella wellardi*, after M. G. E. P. Wellard, manager of Dalgaranga Station, and under whose guidance Professor Nicholls made his excursions.

The discovery of these two new and closely allied species from Western Australia is particularly interesting, because their nearest relative is found in a form *Branchinella frondosa** taken from near Yass, New South Wales, and

* Mr. T. Whitelegge in his list of Invertebrate Fauna (Journ. Roy. Soc. N.S.W., XXIII., 1889, p. 318) refers to three specimens of *Chirocephalus* sp. in Australian Museum collected near Yass, N.S.W. These are the specimens which have been described recently by Marguerite Henry as a new species of *Branchinella*, under the name *B. frondosa*.

recently described by Marguerite Henry. In all three forms the frontal appendage is large and divided into two main branches. Each branch is then further divided according to a plan which differs in the three species. Other representatives of *Branchinella* in W.A. in which the frontal appendage has been described are *B. eyrensis* (Sayce), *B. longirostris* (Wolf) and in these it is built on a much simpler plan, showing only the division of the appendage into two, without further branching. Whilst retaining the generic characters of *Branchinella* these new forms, together with *B. frondosa*, resemble more closely in general appearance the genus *Dendrocephalus* instituted by Daday (1910) to receive two new Phyllopod, one from Central America, and the other from the Argentine, and in the sum of their characters supply an interesting link between the two genera.

Branchinella *Mirabilis*, sp., nov.

(Plates IV. and V.)

Specific diagnosis.—Body stout. Trunk (including cephalon) and tail subequal. Cephalon relatively large, equal in length to first three segments of trunk, segments of trunk subequal. Tail of nine segments, terminal segment much shorter and bearing a pair of caudal rami. Prehensile antennae of male developed as strong claspers consisting of two segments, the first stout, muscular and of cylindrical form, the second shorter, chitinous, bent inwards almost to a right angle and bearing a row of small transverse chitinous ridges along the inner surface. Frontal appendage complexly branched, spinulose, united to frontal base of claspers and extending back to 4th or 5th segment of trunk.

Antennae of female flattened, tapering to a point distally and only slightly longer than antennules.

Branchial limbs.—Eleven pairs all similar and almost equal in size. 1st, 2nd and 11th pairs rather smaller than the rest. They consist of the typical parts—six endites distinctly marked off from stem and from one another; a flabellum which is articulated and very muscular; a gill or branchia and a bract or covering plate usually regarded as an exite. The flabellum increases in size from the first limb where it does not project beyond the 6th endite to the last where it is considerably longer. Branchiae, which are characteristically bare of setae and have smooth margins, are flattened not cylindrical, and much broader than long. The 6th endite bears on its inner margin, in all appendages of the male, 7 knob-like projections which are most conspicuous in the appendages of the middle region of the body.

Caudal rami cylindrical, beset with plumose setae and approximately equal in length to the last three segments of the tail.

Penes of the male (Pl. IV., fig. 7), everted in all three male specimens collected, are sickle shaped and extend to limit of third segment of the tail. The entire surface of the organ is clothed with short recurved spines and the male aperture which is directed anteriorly is surrounded by several tumid areas surmounted with short spines.

Ovisac of female (Pl. IV., Figs 5a, b, c, d) is broad, pear-shaped, arising from first two segments of tail and extending, in mature forms, to limit of third segment. The aperture at distal extremity is guarded by two lips; a dorsal lip which, when closed, overlaps the ventral lip. Dorsal lip is provided on each side with two flaps, scarcely visible when aperture is closed. The ventral lip also has two distinct lateral lobes.

Eggs (Pl. IV., Fig. 6) numerous, relatively small. They are subspherical and sculptured with irregular hexagonal facets bordered by ridges.

Length.—Largest male, exclusive of Caudal rami, 29 mms.
Largest female „ „ „ 26.5 mms.

Colour.—Translucent, and in life almost transparent. The lack of pigment in the body renders them invisible except for caudal rami, which are a vivid reddish orange, and the egg sac of mature female, a reddish brown colour owing to contained ripe eggs.

Locality.—Muddy pools on Dalgaranga Station, 60-70 miles North-East of Yalgoo, W. Australia.

Detailed Description.—Male and female specimens almost identical in general body form, the females only slightly smaller and differing from the males in the character of the antennae, in the presence of a median ovisac which is replaced in the male by a pair of penes, and also in the absence of any knob-like projections on the margins of the branchial limbs. In both sexes the body is elongate, compressed from side to side, and almost equally divided into anterior segment which includes the cephalon and trunk (mesosome) and a posterior segment forming the tail. The segments of the trunk bear eleven pairs of swimming appendages or branchial feet. The segments of the tail are devoid of any appendages except the last to which is articulated a pair of setose caudal rami.

Cephalon (Pl. IV., Figs. 1, 2 and 3).—Large and equal in length to first three segments of trunk. It is divided by a distinct groove into an anterior part and a smaller, so-called, cervical segment. The anterior part, which occupies two-thirds the extent of the cephalon, bears two large and prominent stalked eyes and a median eye or ocellus. Behind the latter is the so-called "dorsal organ" a circular patch of modified cephalic ectoderm. The cervical region of the cephalon is slightly deeper, the side walls projecting downwards on each side in form of pleura and presenting rounded margins.

Trunk (Mesosome) consists of eleven segments subequal in length and breadth.

Tail (Metasome) is formed of nine segments, the first two (genital segments) bear on the ventral surface two penes or an ovisac, the remaining seven gradually become narrower hindwards. The segments are subequal in length except the last which is much shorter, and from it extend a pair of posteriorly directed and somewhat divergent caudal rami.

Appendages.

Antennules (Pl. V., Fig. 12).—These are similar structures in both sexes. They are elongate, filiform appendages, and are devoid of setae except at the tip which is provided with a tuft of sensory hairs, consisting of three long setae and a greater number of finer, olfactory setae. They present no other characteristics except a slight prominence which occurs near the middle of the appendage. In the female the antennules are almost as long as the antennae, but in the male they scarcely extend to the limit of the first joint of the claspers.

Antennae.—In the male (Pl. IV., Fig. 10).

These appendages are modified as powerful claspers, consisting of two segments, and bearing also, as an accessory copulatory structure, a well developed frontal appendage. The basal joint of the clasper is extremely large, cylindrical in shape, muscular, and with its surface bare except for

inner margin which is clothed distally with a coat of very minute hairs. The second joint is much narrower and, where it articulates, is about two-thirds the width of the first joint. Distally it narrows gradually, curving inwards so as to form almost a right-angle bend and ends in a blunt point. The inner margin of the distal half of second joint is provided with a row of transverse chitinous ridges. These give the appearance in lateral view of twenty or thirty small conical chitinous teeth.

The frontal appendage (Pl. IV., Figs. 4a and 4b) is extremely large, complexly branched and covered with short stout spines. It is attached to the frontal base of the antennae and forms a squarish plate which covers the lower surface of the head. Beyond this plate it divides into two, each half exactly similar, complexly branched and studded all over with spines. The inner margin of each branch of the appendage is bare for half its length, but the distal half gives rise to five elongate, cylindrical processes unbranched, but provided with short stout spines. From the outer margin arise, at equal distances along its length, five stout cylindrical processes and each of these is irregularly pinnately branched and heavily studded with spines. These outgrowths diminish in size and complexity of branching from the first to the fifth which presents only two short branches and resembles very closely in size the corresponding branch of the inner margin of the appendage.

When not in use this appendage is coiled up and lies along the ventral surface of the body, held in position by the claspers which surround it. (Pl. IV., Fig. 2).

In the female (Pl. V., Fig. 11) the antenna is comparatively simple in structure. It is quite short, only slightly longer than the antennule, but is much broader and more leaflike, tapering to a sharp point distally. Except for a few scattered setae on the outer margin, the surface of the appendage is quite smooth.

Mouth Parts.

Labrum or upper lip (Pl. V., Fig. 13) is well developed and forms a triangular, plate the apex of which is directed backwards and overlies the mandibles. The latter (Pl. II., Fig. 14) are well developed and are provided with a double chitinous biting edge. They are elongate structures pointed where they articulate with the cephalon and curve downwards and inwards so as to meet in the middle line at the mouth. Of the *Maxillae* only one pair is developed; the second is either lacking or not developed into a mouth appendage. They are in the form of a small triangular plate (Pl. V. Fig. 15) with a broad setose biting edge, the setae of which are as long as the appendage itself.

Branchial limbs (Pl. V., Figs. 8 and 9).—These are all similar and differ only in size and the relative proportions of the several parts. The inner margin of the limb bears six endites or gnathobases which are abundantly supplied with plumose setae and serve to direct the food current forward to the mouth. The first and second endites are shallow leaf-like projections of the appendage, provided with very long plumose setae along their convex margins. The third, fourth and fifth endites are smaller, but subequal, and in the form of three conical outgrowths of the limb. The third endite bears two short stout unequal setae at the apex of the cone and three strong and very long plumose setae. The fourth endite agrees with the third in the disposition of setae except in possessing only two long plumose setae. The fifth agrees with the fourth but possesses only one stout spine on its apex. The sixth endite is the largest of the series and is less densely beset with setae. In both male and female this endite projects considerably beyond

the level of the other five. Its inner margin bears seven spines, conspicuous in the female but reduced in the male and obscured by seven knob-like projections which arise from the posterior surface of the endite immediately below the spines. These knobs are curved inwards and are directed forwards. They are most conspicuous in the middle region of body where they form prominent conical projections of the endite. Occurring as they do only in the male, they suggest additional copulatory structures. The posterior margin of the sixth endite is beset with short plumose, spine-like setae. The flabellum is distinctly articulated to the appendage and is well provided with muscles acting no doubt as the most important swimming organ of the appendage. It varies in size from the first, where it does not project beyond the sixth endite, to the last, where it is considerably larger. The entire margin is beset with long plumose setae. The exite forms a large ovoid covering plate or bract, the margin of which is slightly serrated. Projecting from the outer surface of the appendage, between the bract and the flabellum, is a gill or branchia. In this species it has a flattened leaf-like form, lying over the bract and rather similar to it in shape, although smaller. Its margin is smooth and devoid of setae or any indentations.

Caudal rami.—These are elongate cylindrical structures, articulating with posterior segment of tail and tapering gradually to a blunt end. They are beset along their posterior and lateral margins with fine plumose setae. These appendages are apparently delicate structures, easily lost in life. Regeneration takes place readily as evidenced by the fact that, with the exception of one or two perfect specimens, all the specimens in the collection showed either one or both rami in stages of regeneration.

Specific Diagnosis.—Body moderately stout, of normal form, tail, including caudal rami, about quarter longer than trunk and cephalon combined. Claspers of normal form, the second joint longer than the first and curved inwardly, making an angle of about 45° . Distal extremity straight, forming a rounded end with a sharp point on the inner margin. Entire inner surface of second joint with a row of prominent chitinous ridges, directed backwards and each one approximately hemispherical in shape.

Frontal appendage excessively branched, extending beyond the limit of the claspers and reaching to fourth or fifth segment of the trunk. Proximally, where it is attached to the head, it forms a wrinkled band or ribbon, which, when the appendage is not in use, hides the under surface of the head. Distally it expands slightly, giving off two long cylindrical, branched outgrowths which form the main part of the appendage, and then terminates suddenly, the distal border being slightly emarginated in the middle. The two outgrowths are exactly similar. From the outer margin arise nine cylindrical processes, unbranched, which decrease progressively in size from the first to the last. The inner margin bears seven similar lateral branches. All of these outgrowths are thickly set with long and short spines and in addition, the distal half of the main stem of the appendage is grooved along the under side and this is also beset with spines.

Antennae of female similar to those of *B. mirabilis*.

Branchial feet all similar. They are relatively longer and narrower than those of *B. mirabilis*. The first and second pairs are very small, the remaining nine pairs subequal. They agree with the former species in most respects, the covering plate or bract, however, not being so well developed. Branchiae are cylindrical, not leaflike, and they are much longer than they are broad, differing entirely in shape from the bract. The males of this

species, like those of *B. mirabilis*, possess knob-like projections on the sixth endite, but these are fewer in number and are lacking altogether in appendages ten and eleven and insignificant in first and second pairs. Disposition of setae on endites three, four and five, as in *B. mirabilis*.

Ovisac similar in shape to that of *B. mirabilis* but relatively longer, extending slightly beyond the fourth segment of the tail. Projecting from the ventral surface and in the middle line there is a small lip or ridge similar to that described by Sayce (1902) in *B. australiensis* and possibly of use during copulation. The opening of the ovisac is guarded by two simple lips, a dorsal and a ventral lip, and when closed the dorsal lip slightly overlaps the ventral.

Eggs are not so numerous but relatively much larger than those of *B. mirabilis*. They are similarly sculptured, and although the adults of two species differ greatly in size the eggs are scarcely distinguishable.

Penes of male when everted are long and spinulose, extending beyond the fourth segment of the abdomen. The outer surface is clothed with strong recurved spines, whilst the distal and inner surfaces possess stouter spines with swollen bases, all directed backwards.

Length.—Male and female exclusive of caudal rami—14 mms.

Locality.—Dalgaranga Station, 60–70 miles North-East of Yalgoo, Western Australia.

Affinities.—In discussing the affinities of these two new species with allied forms, an interesting feature presents itself in *B. wellardi*. In a number of specimens in the collection there is present a distinct outgrowth or lobe which arises from the inner margin of the first segment of the claspers and projects slightly at the junction of the first and second segments. (Text fig. 9a.)

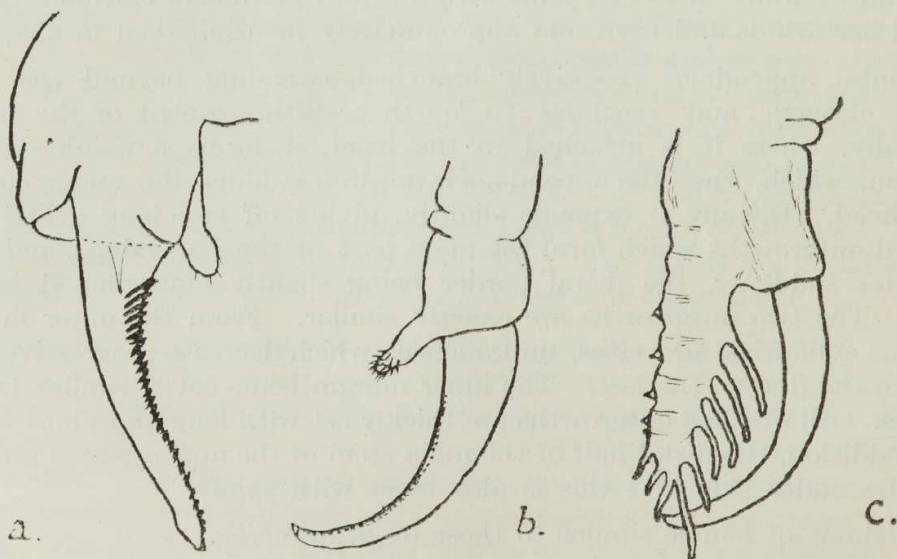


Fig. 9.

Fig. 9.—(a) Clasper of *Brancajinella wellardi*, showing maximum development of accessory lobe.

(b) Clasper of *Dendrocephalus geayi*.

(c) Clasper of *Branchinellites kugenumaensis*.

This outgrowth varies in size in the specimens in which it occurs and is never more than a thin membranous lobe possessing at its margin a few short setae. A similar outgrowth, although much larger and considerably lobed, is to be found in a form which Daday originally described as *Branchinella kugenumaensis* from Japan. On the discovery of a second very closely allied species from Western Africa a little later, he removed *B. kugenumaensis* from the genus *Branchinella* and instituted a new genus to receive these two species. To this genus he gave the name *Branchinellites*, which differs from *Branchinella* chiefly in the presence of a serriform lobe on the basal segment of the clasper.

The occurrence of an accessory lobe on the clasper is a common feature amongst members of the Anostraca. *Branchinella*, however, is described as lacking any accessory lobe or spur other than the frontal appendage. In *Chirocephalus* and allied genera, viz., *Chirocephalopsis* and *Pristicephalus*, it is a conspicuous lobed structure. In *Dendrocephalus* it takes the form of a small digitiform process projecting from the inner angle of the clasper at the junction of the first and second joints and is thickly beset at the tip with spines or hairs. (Fig. 9b.) It is most conspicuous in *Branchinellites* (Fig. 9c) where it is considerably lobed and projects to the limit of the second segment of the clasper.

The specimens of *B. wellardi*, which possess this accessory lobe on the clasper, come very close to the genus *Branchinellites*. They may be separated from it only by the nature of the outgrowth itself, which is never more than a simple lobe, devoid of any serrations and not in any way lobed. The extreme variability of this lobe and in most specimens its absence altogether would prevent *B. wellardi* from being assigned to genus *Branchinellites*. This species may therefore be regarded as a transitional form intermediate between the two genera, *Branchinella* and *Branchinellites*.

In the complex nature of the frontal appendage the two new species resemble closely *Dendrocephalus*. They differ, however, in the character of the limbs. These are all alike in *Branchinella*, but in *Dendrocephalus* the first and second pairs in the male are notably different from the rest. With the exception of one species *B. frondosa*, *B. mirabilis* and *B. wellardi* can be readily distinguished from other described species of the genus by the complicated branching of the frontal appendage. This structure is divided into two main branches only, which do not further branch in *B. australiensis*, *B. eyrensis*, *B. ornata*, *B. longirostris*, and *B. proboscida*. The two new species may be readily distinguished from one another and from *B. frondosa* by the form of the frontal appendage, the size of the body, and the relative proportions of the body and of its appendages.

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28-30.

EXPLANATION OF PLATES.

PLATE IV.

All figures refer to *Branchinella mirabilis*, sp., nov.

- Figure 1.—Lateral view of *Branchinella mirabilis*.—male specimen.
 „ 2.—Anterior view of head of same, showing relationship of
 claspers and frontal appendage when latter is not in use.
 „ 3.—Head of female (Dorsal view).
 „ 4a.—Frontal appendage showing right half uncoiled.
 „ 4b.—One branch of same enlarged.
 „ 5a.—Egg sac and related segments of body in the female.
 „ 5b.—Lateral view of female aperture—closed.
 „ 5c.—Lateral view of female aperture—open.
 „ 5d.—Ventral view of female aperture.
 „ 6.—Mature egg.
 „ 7.—Penes of male—everted.

PLATE V.

All figures refer to *B. mirabilis*, sp., nov.

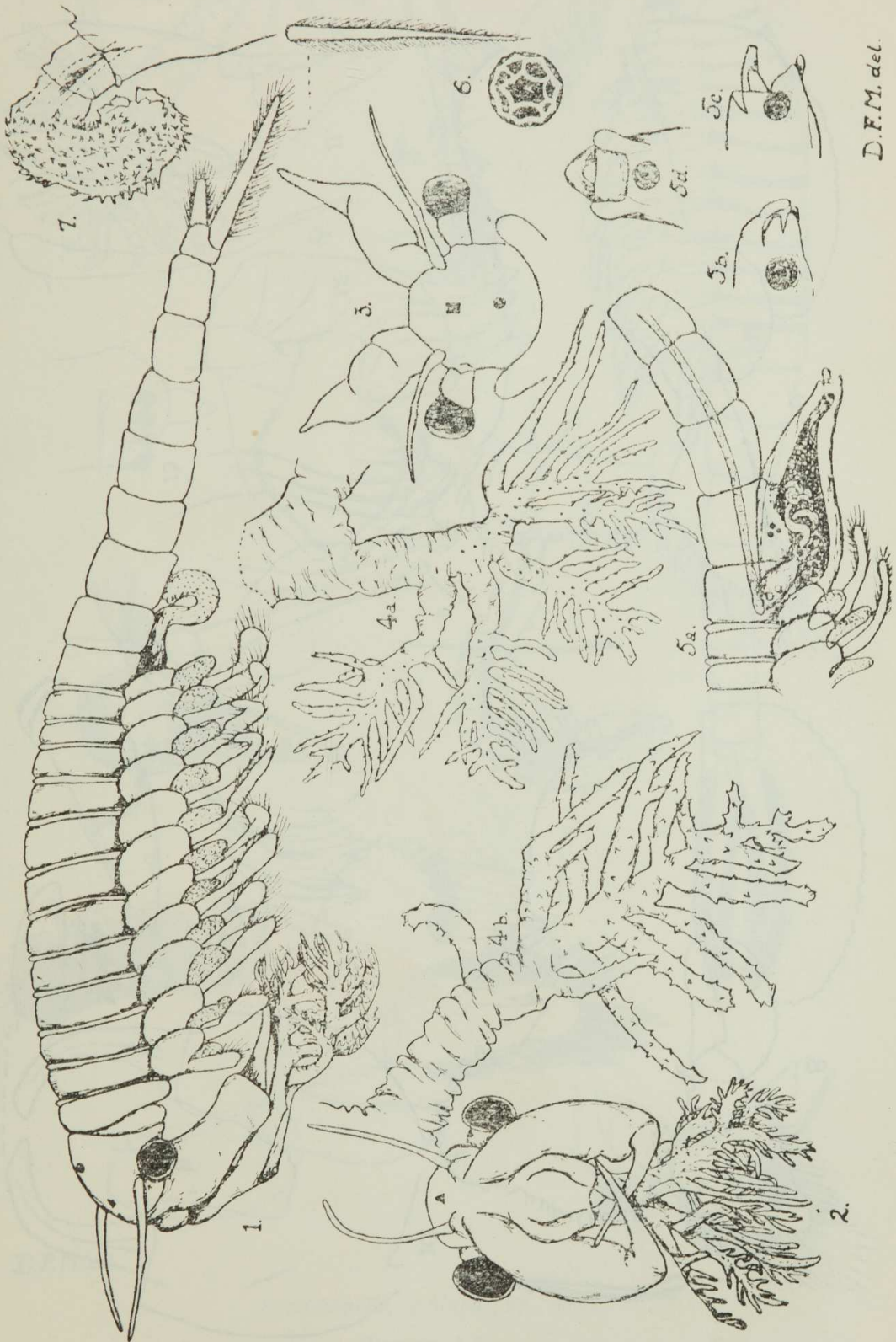
- Figure 8.—3rd Thoracic limb of male.
 „ 9.—8th Thoracic limb of female.
 „ 10.—Claspers (Antennae of male).
 „ 11.—Antenna of female.
 „ 12.—Antennule of female.
 „ 13.—Labrum.
 „ 14.—Mandible.
 „ 15.—Maxilla.

PLATE VI.

All figures refer to *B. wellardi*, sp., nov.

- Figure 1.—Latera, view of *Branchinella wellardi* (male).
 „ 2.—Dorsal view of head of female.
 „ 3.—Ovisac of female and related segments.
 „ 4a.—Frontal appendage showing right half uncoiled.
 „ 4b.—One branch of same enlarged.
 „ 5.—Claspers (Antennae of male).
 „ 6.—Penes of male everted.
 „ 7.—Eighth Thoracic limb of male.

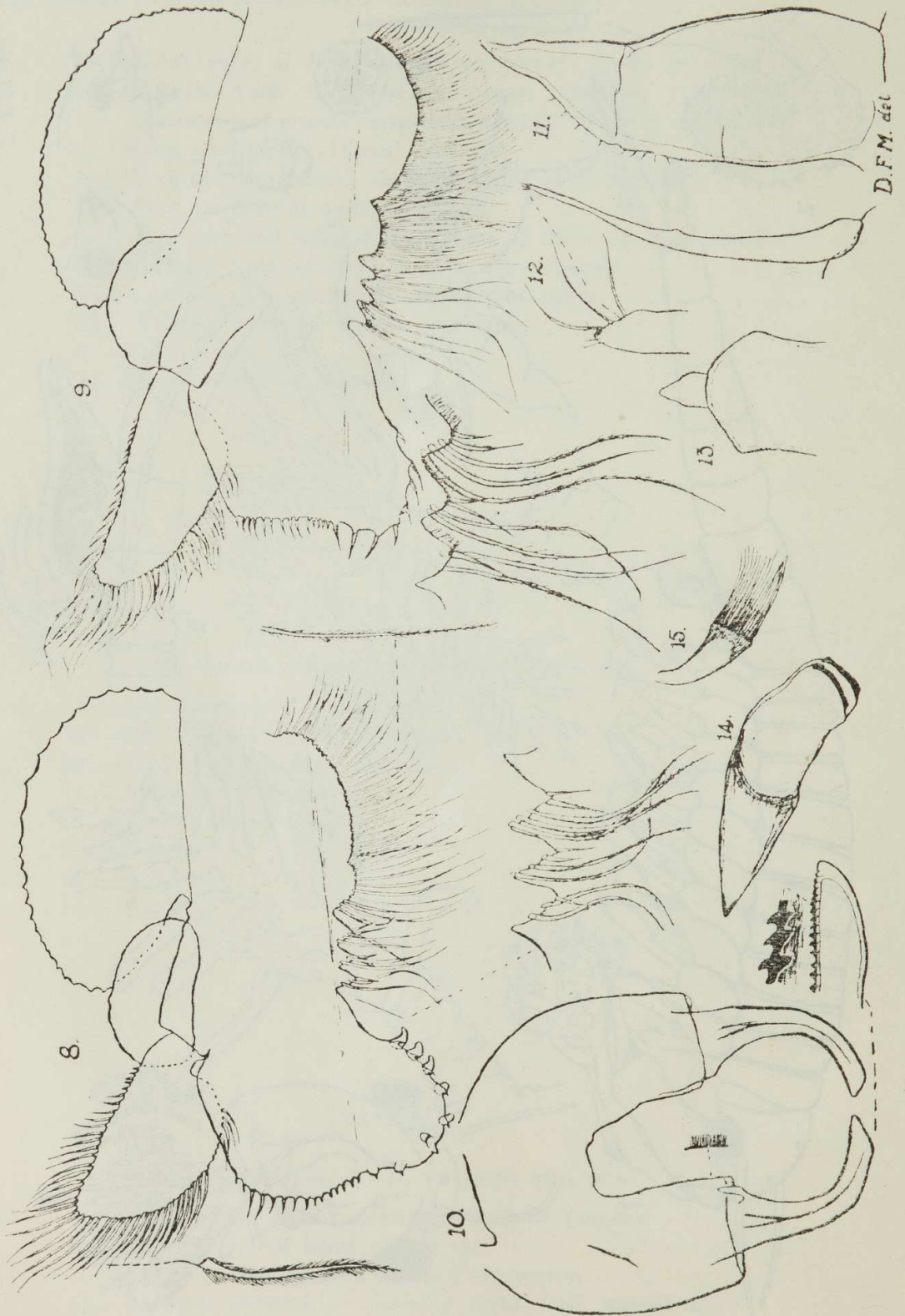
PLATE IV.



Branchinella mirabilis, sp., nov.

Figures 1-7,

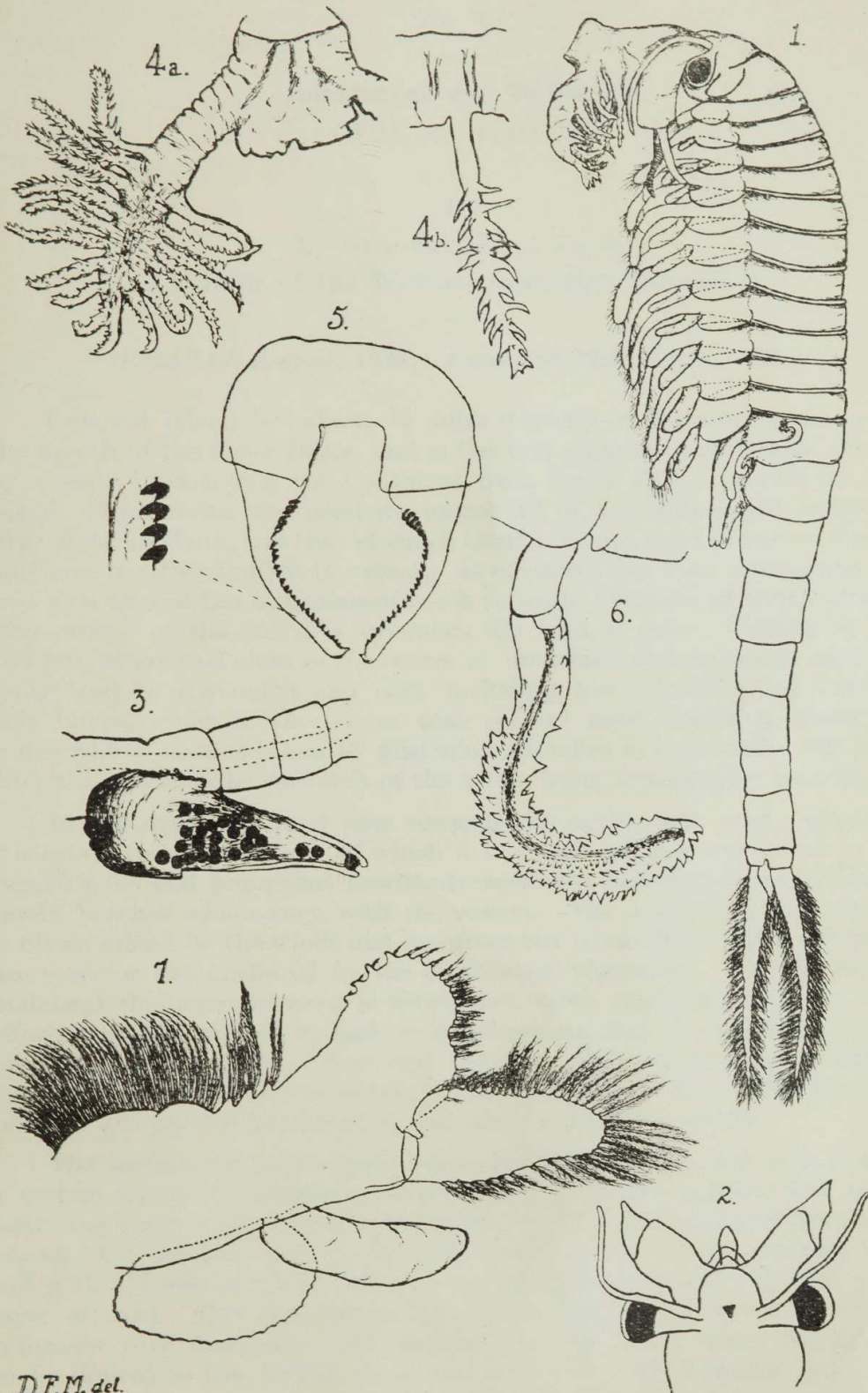
PLATE V.



Branchinella mirabilis, sp., nov.

Figures 8-15.

PLATE VI.



D.F.M. del.

Branchinella wellardi, sp., nov.

Figures 1-7.